DEPARTMENT OF EDUCATION AND SCIENCE
NATIONAL ADVISORY COUNCIL ON EDUCATION
FOR INDUSTRY AND COMMERCE

A REPORT ON THE USE OF BUILDINGS AND EQUIPMENT

by the

Committee on the More Effective Use of Technical College Resources

LONDON
HER MAJESTY'S STATIONERY OFFICE
1968

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The estimated cost of the preparation of this Report is £760 5*s*. 0*d*. of which £300 5*s*. 0*d*. represents the estimated costs of printing and publishing the Report.

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The Committee on the More Effective Use of Technical College Resources was established by the National Advisory Council on Education for Industry and Commerce in March 1964 with the following terms of reference:

> "In the light of the expansion of their work now in hand, and the further demands which national developments are likely to place on them, to suggest ways of making the most effective use of the resources available and expected to become available in technical and other colleges of further education."

This report, the second of a series, was received by the Council on 22nd November, 1967, who resolved that it should be submitted to the Secretary of State with the Council's approval.

Members of the Committee

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Sir Joseph Hunt, M.B.E. (Chairman from January 1967)
Sir William Alexander
Dr. Frank Briers, O.B.E.
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NATIONAL ADVISORY COUNCIL ON EDUCATION FOR INDUSTRY AND COMMERCE

Committee on the More Effective Use of Technical College Resources

A REPORT ON THE USE OF BUILDINGS AND EQUIPMENT

INTRODUCTION

1. The last ten years have seen the expansion of the country's system of further education at a rate altogether without previous parallel, and a period of further rapid growth lies ahead as the effects of the Industrial Training Act and other developments, such as the continued expansion of higher education within the further education system, are increasingly felt. It was against this background that the National Advisory Council on Education for Industry and Commerce, with the approval of the Secretary of State, appointed us to suggest ways of making the most effective use of the resources available and expected to become available in technical colleges. It was clear that in a period of continuing expansion and constantly changing requirements colleges could only adapt fully to new needs and raise educational standards if all possible assistance was given to them in using the available resources to maximum educational advantage.

2. We have undertaken a number of enquiries into various aspects of this question. Our first report* considered the contribution of arrangements for approving courses to the more effective use of resources. In the present report we look at possible ways of making more effective use of the plant—the buildings and equipment—at the disposal of colleges.

3. This problem is of course common to all colleges. Every college is faced with the need to adapt its plant to changing educational needs and to new ideas and techniques for using it in order to produce better educational results. In present day conditions it will not be long before even the best planned buildings are to a greater or lesser extent ill-adapted to requirements which could not have been foreseen when they were designed. In the longer term it may be possible to ease the problem by improvements in the initial design of buildings to provide for greater flexibility, and we welcome the increasing attention which is being given to the complex and highly technical issues connected with the design of new buildings. But improvements in future design will not provide the answer to the short term problem of using existing plant to the best advantage, and, as our enquiries have shown, there is much that can be done—in some cases with educational benefit as well as with advantages in convenience—to improve the use of existing buildings and equipment. The need will be greater where the facilities are under heavy strain because of rapidly growing demand, and we have had particularly in mind the problems which face colleges in this position. But for the most part the suggestions in this report are of general application.

* Report on the Size of Classes and Approval of Further Education courses.

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They are all based upon actual experience in the field, and we believe that they will be of interest and assistance to authorities and colleges generally.

4. In preparing the report we have collected information about:—

(*a*) the problems which face colleges in adapting existing premises and equipment to changes in the scale and nature of the demand and in educational methods and requirements; and

(*b*) the steps which have been taken to deal with these problems within the existing resources.

We are indebted to the local education authorities and colleges throughout the country who have supplied us with information and to the education officers, principals and others with whom we have had discussions.

5. The most suitable action will depend on the particular circumstances and there is no question of suggesting solutions capable of universal application. But we think that it may be helpful to authorities and colleges to have the benefit of some general guidance based on the information which has been collected, and to be aware of some of the suggestions which have been made to us and some of the steps which individual authorities and colleges have taken to deal with problems which in one form or another are likely to arise elsewhere. The report, therefore, includes first, some general observations and guidance, and second, an appendix (Appendix I) giving extracts from the replies received to our questionnaire about action actually taken in particular colleges to improve the use of buildings and equipment.

6. This would not have been possible but for the co-operation and interest of the colleges, and we have been much impressed by the imagination and ingenuity with which so many of them are tackling their problems, often under difficult conditions, and by their readiness to share the experience and to learn from the experience of others. The cases given in Appendix I, a limited selection from the large number of examples received, vary in importance and in general relevance, but even where they concern matters of comparative detail affecting limited fields of work we have thought them worth recording as illustrating possible lines of approach which others may wish to follow. Common to them all is the same determination to make the fullest use of the available resources in order to help the staff to provide the best possible service to the students. This must always be the test.

Communal and corporate life of colleges

7. Throughout our enquiries, and particularly during interviews, we found considerable concern about the provision and use of communal and social facilities in colleges and a desire not to lose sight of broader educational opportunities. It is clear that much can be done to widen the interests and broaden the experience of students through student unions and the many social and corporate activities that should be possible in a balanced and well-conducted establishment. Many principals and teachers are concerned that the nature of day release work, the impact of travelling, and other conditions of study, do not allow these broader purposes to be sufficiently pursued, and some urged that the facilities should be much improved. We have much sympathy with this point of view, and

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have taken it fully into account in compiling this Report. Some of the difficulties are inherent in patterns of attendance and other conditions of study. On the other hand, much has been done, especially by general and liberal studies staff, to improve the position. We hope that this will continue and that with the support of employers, there will be increased emphasis on this important aspect of college life. At the same time it is clear that space and equipment are not always available on the scale which is desirable. It may be that the urgency of technical change, the demands of technical syllabuses, and the conditions for the approval of courses, tend to place a premium on the provision of technical facilities. Certainly the need to provide a broader educational experience is an added reason for maximum efficiency in the use of premises so that better provision can be made for communal and corporate activities.

THE PROCEDURE FOLLOWED

8. The procedure which we have followed is described in detail in Appendix II. The responsibility for collecting the information, for conducting the many interviews and discussions with people experienced in the organisation of colleges both as administrators and teachers, for undertaking the visits involved, and for the initial drafting of the report was carried out on behalf of the Committee by a Sub-Committee consisting of Mr. J. Longden as Chairman, Mr. S. J. Noel-Brown, Dr. F. Lincoln Ralphs, and Mr. Alan Reed and Mr. D. A. G. Reid (both co-opted). Their colleagues wish to place on record their appreciation of the help given by the Sub-Committee.

WHAT CAN BE DONE?

Surveys of accommodation and equipment usage

9. The information we collected on this subject showed that in the selected colleges usage of teaching accommodation varied from less than 10 hours per week to more than 50 hours per week. In some cases no doubt the low usage was unavoidable, especially where highly specialised equipment was involved, but we found that some colleges had been more successful than others in achieving a high level of use, often with significant educational gain. We are impressed by the extent to which this has been done by taking advantage of the distinctive character of technical colleges and applying methods of management and self-help, which are not generally possible in other educational establishments.

10. Colleges vary considerably in the extent to which they make systematic analyses of the use of rooms. This seems to us essential to the best deployment of resources, and we recommend that all colleges should carry out regular surveys of the actual use of buildings and equipment.

Timetabling

General

11. A timetabling system should show:—

(i) the arrangement and distribution of courses and classes;

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(ii) the loading of rooms in terms of time, subject and student numbers;

(iii) the loading and location of staff.

Technical college timetabling is necessarily an extremely complex operation. Not only are there the main variables of subjects, rooms, and staff, but conditions may change from term to term or even more often. Courses and staff may change, and the number of students in a course may expand or contract, requiring extra classes or the combining of classes. There is a sharp contrast with the relatively fixed population and curriculum of even a large secondary school. A closer parallel is the progress control procedure of a productive enterprise where all the variables have to be continuously charted and plotted to ensure that there is a complete and accurate picture at any time. Variations of demand are a problem where there are courses of different duration, and the provision of block release courses can accentuate them. In the absence of accurate charting which reflects changes as they occur, the staff of even a small college must find it hard to know whether facilities are fully employed; it is also clearly difficult to review timetabling policy, to assess the relative loads on different rooms, to isolate peaks and troughs in demand and to correlate inter-departmental factors. Good timetabling is essential as a forecasting technique.

12. Developments such as block release, staggered industrial holidays, and the need to make extended use of premises, are rapidly making the single date of entry and the traditional enrolment procedures out-of-date. The notion that enrolment is a once-for-all effort is ceasing to be valid, and timetabling cannot be an annual task, but must be subject to continuous review throughout the year.

Staff and equipment

13. The importance of timetabling is often insufficiently appreciated; and it is frequently done with inadequate staff and equipment, even in large colleges. Yet it is one of the keys to full utilisation of resources. Except in the simplest cases it cannot be undertaken efficiently as an ancillary duty of one of the teachers, and any necessary expenditure on the employment of special staff and equipment, such as the mechanical charting systems which are available commercially, should be more than amply repaid.

Some suggestions

14. The object of timetabling is to use staff and rooms as efficiently as possible within the limits set by the available accommodation, equipment and time. Classes must as far as possible be assigned to the rooms best suited to their work and size of group. These aims can be achieved with maximum effect only under a system of centrally controlled room allocation which recognises that the organisation of the college by departments is an administrative convenience which should not be allowed to break the college into isolated units. It follows that central direction must be a responsibility exercised by the principal or his deputy, and must be operated by a system not departmentally based. This does not mean that in certain cases the responsibility for allocating specialist rooms should not be assigned to the departments concerned, but even with these

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consideration should be given to the extent to which they are capable of inter-departmental use. A system used by several colleges is for departments to plan their own room usage initially and then co-operate to fit departmental patterns together. This is sometimes done by allocating a few classrooms to each department and then dealing with each surplus or deficiency centrally; when necessary classes are also switched to different rooms according to their sizes.

15. A uniform time grid into which the class periods throughout the college are fitted is essential to effective central planning. It enables interchange of classes between departments in the use of rooms, and facilitates the arrangement of courses which require the teaching services of different departments, and the regrouping of students from different courses for particular study periods. Workshop and laboratory periods will usually differ from class and tutorial periods and this must be allowed for in the unit framework.

16. The staff must be fully consulted before a common grid is introduced. They may be understandably reluctant to give up arrangements to which they are accustomed and to accept others which reduce the freedom of action of individual departments. We are aware of one college which carried out a thorough operational study over a period of eighteen months before selecting its particular standard grid.

17. Refectory loading is a major factor in timetabling, and it seems generally accepted that morning and afternoon breaks need to be staggered even when additional supply points are available in other parts of the college. (Although completely uniform loading of teaching spaces throughout the day cannot be expected, considerable gains have been made by re-considering traditional breaks, which are often dictated by local habits. Many colleges already stagger lunch and tea breaks. The lunch break is usually about one hour, but is often staggered over periods up to 2½ hours, which spreads the load in the refectory and permits also of staggered use of rooms.) The desirability of a common break time for the entire college so that students can meet each other was suggested by some principals. But there are other and more effective methods of developing the corporate life of an institution than by providing the limited opportunities for contact between students in different courses which are offered by short breaks, and students are likely to benefit more from the smoother running of the college made possible by a good system of timetabling.

18. Many colleges have introduced the so-called 'twilight' classes, which are usually arranged for part-time day students, in order to extend study time without the need for them to return on other evenings; and staggered tea breaks are a useful part of this arrangement. Such classes often finish in time to make rooms available for evening classes. We are aware that there is considerable difference of opinion about this practice. Some contend that conditions of study become too arduous, but there is evidence that this need not be the case when there is a proper succession of subject periods, breaks and tutorial periods. Where additional time is needed and solutions such as block release are not possible, the practice may be less demanding than repeated travelling. We understand that some students prefer the resulting arrangements and the freedom they give from

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repeated attendance. Nor should it be overlooked that opportunities for increased private study and for personal and social development may also result.

19. In some branches of study a common practice is to make provision in the timetable for both specialist rooms and classrooms to be available simultaneously for one particular group. This results in rooms either being left empty or only partially used. Many colleges, however, have achieved fuller use without educational disadvantage to the students, by arranging for classes to occupy the accommodation in rotation.

20. Differences in the length of college courses can lead to vacant blocks of rooms for days and even weeks unless there is very careful planning. Several colleges have mentioned the difficulty of fitting into one organisation part-time and full-time courses with block release and sandwich courses. Some colleges level the demand by running sandwich courses that overlap and by arranging block release courses in the periods when there is only one sandwich group in the colleges; others arrange their 'specialist short courses' during the less heavily loaded periods. These are sensible practices, but the difficulty in producing a uniform loading with ever increasing numbers of courses will most certainly become greater unless some attempt is made to standardise the pattern of courses in any one establishment. It will, for example, be helpful if a college can arrange a pattern of block release and sandwich courses which includes a common period of time as a module round which attendance by students on either type of course can be planned.

External influences

21. The practice of some external bodies, which lay down details of course patterns so precisely that a time allocation is implied for each subject, is not conducive to efficient timetabling. It would be helpful if external bodies would agree that their patterns of study should be for general guidance only, and that the actual details could be left to colleges provided that the time spent on particular subjects over the whole course met with their requirements.

22. An even greater difficulty experienced in the arrangement of courses is the rigidity imposed by external examinations. Under a system of external examinations this cannot be removed completely but it would be lessened if the number of such examinations was reduced to the essential minimum. The idea of continuous assessment of students by the college, as opposed to annual assessment by external examination, is gaining ground. Most national certificate and diploma schemes already allow for promotion from the first to the second year of the course on the basis of the college's own assessment of the student, thus making an external examination unnecessary at that stage. There are strong arguments on educational grounds for discontinuing the practice of annual external examinations, and it would undoubtedly facilitate the better use of resources through more efficient timetabling. We recommend that the Department of Education and Science should continue to explore this question with the appropriate examining bodies.

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Use of classrooms

23. We doubt whether in general enough thought has been given to the function of classroom spaces either from the broad educational point of view or specifically in relation to effective use of accommodation. By and large classrooms are still thought of as desk/chair/blackboard areas intended for formal lecture purposes. Some colleges, however, see such a classroom as a universal teaching space capable of 100 per cent utilisation for a variety of purposes. There seems to us to be a great deal to be said for this view, even though it may be necessary to take to such classrooms any equipment required for demonstration or illustration. Some rooms may be arranged as specialist teaching rooms in which all the material is at hand, properly arranged and specially suited to assist teaching; in others more than one specialism may be handled by careful design of the room, and such arrangements need not prevent the use of the room for normal classroom purposes as well. Where closed circuit television is installed it has the effect of bringing demonstrations into the classroom and reducing the unnecessary movement of students.

24. Classrooms are often unsuitable for tutorial activities because the layout and furnishings are inappropriate, and we have been interested to learn of experiments with furnishings other than the conventional desk and chair. Furnishings in which writing surface and chair are combined, or which allow easy re-arrangement of the room, permit a room to have differing functions. The right approach is to settle the purposes of the room and then devise the layout and furniture best suited for those purposes. Many colleges, however, have school furniture which limits considerably the usefulness of the classroom. Better educational results would be achieved by using furniture which was chosen or designed to facilitate multiple use of the classroom.

25. Except in workshops, and sometimes in laboratories, it often seems to be assumed that classes or courses should not be combined. We do not advocate a return to the system under which different years of a course were combined for the sake of increasing the size of the group. But the possibility of other forms of combination should be explored more fully, especially for project and tutorial work for which different groups can very well be combined often to educational advantage.

26. Rooms can be under-used because they are assigned to a particular department and are not in all respects suitable for use by another. Yet by joint planning they could often be made suitable for two or more departments. We quote in Appendix I some examples of what can be done by joint use. A more flexible use of accommodation would also be possible if the size of rooms could be modified to suit particular needs by the use of easily movable partitions.

Use of laboratories

27. Laboratories are relatively expensive in capital and running costs, and they tend on the whole to be less intensively used than classrooms. It is, therefore, of special importance that everything possible should be done to use them effectively—in the interests of those who work in them no less than the interests of

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the college as a whole. This is a subject on which we have received particularly interesting material from colleges. It is obviously one to which much thought is being given.

28. Some colleges have made improvements in the light of recent technological changes, increasing the relevance of the teaching to industrial needs and saving valuable space by using the more compact equipment becoming increasingly common in industry. Changes in the content of engineering and other courses have reduced the need for specialist laboratories in some instances and have facilitated the joint use of equipment and accommodation. There are still colleges, including some of the large ones, which have under-used laboratories but do not appear to have considered seriously the possible use of common equipment and facilities for related disciplines, often because of traditional subject boundaries. Others have successfully combined the facilities for, say, several engineering disciplines in one teaching space. Apart from the saving in space, maintenance and class supervision, such arrangements have the advantage of bringing those concerned closer together. We hope that colleges generally will consider the possibilities of educational improvement and economy by examining the provision of laboratories and equipment in relation to the changing needs, and to the adjustments which are called for in the customary interdepartmental and interdisciplinary boundaries. Some of the replies quoted in Appendix I show what can be done and will, we believe, be of wide interest.

29. We would also draw attention to the successful use of portable and adaptable furnishings in laboratories. This has not only been found to make better use of the available space. It facilitates maintenance, and makes it easier to adapt to changes in method and syllabus. Many items of equipment, even heavy ones, need not necessarily be permanent fixtures. More could be done to make laboratories more flexible in use by designing the layout so that, for example, advantage can be taken of the modern types of demountable electrical supplies, and by placing the storage facilities where they can best contribute to efficient moving and stocking of equipment.

Use of workshops

30. Workshops should be in the right relationship to each other and if they are not the possibility of rearranging them should be examined. The diagram Fig. 1 on page 9 shows an example from a particular college of a sensible response to this problem in relation to plumbing and welding. Plumbing methods and skills are changing. Lead work is giving way to the use of other material such as plastics, and the welding of pipes is increasing in importance. Welding courses are often difficult to form because of the nature of the training and the distribution of welding workers in many parts of industry. In very many places the number of students in each category is significant but not sufficient to give full utilisation of two workshops. If, as in the example, they are combined, double provision for welding is avoided and it is possible within the same area to provide the additional space which is now needed for plumbing. Since the welding shop is also adjacent to the motor vehicle repair shop, it can also easily be used for body repair and for the ancillary training of motor mechanics.

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FIGURE 1

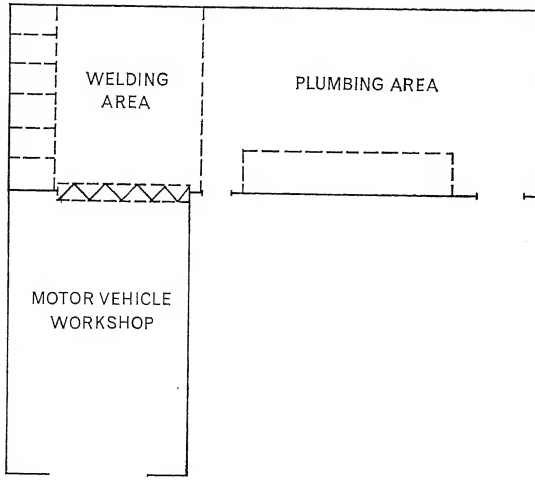
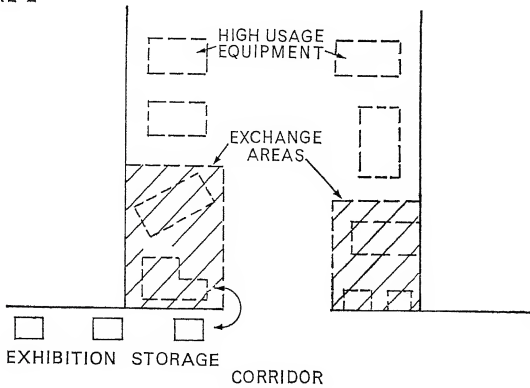


FIGURE 2



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31. An important factor which does not seem to have received enough attention is the amount of use of a machine in relation to the floor space which it occupies. Machine tools in particular are commonly regarded as fixed items of equipment, although most do not need to be bolted to the floor and can be moved very easily with modern equipment and the right handling techniques. In some engineering shops, as much as one-third of the equipment, though essential, may be used for only a quarter of the college session. In these cases machines are needed primarily for demonstration or experimental work as distinct from manufacture, yet they may obstruct for much of the year a sizeable floor area which could be used successively for different items of equipment. In one college, machines taken out of service are placed in the adjacent corridor where they form useful self-teaching exhibits. This situation is illustrated graphically in Fig. 2 on page 9. We refer later to the possibility of such machines being exchanged between colleges.

32. In a number of cases quite heavy equipment has been made portable thus enabling a greater variety of equipment to be used. Adequate storage space is essential. Under-bench space or specially constructed mezzanine floors can assist storage. The proper planning of storage layout and the use of suitable racking and stacking devices are of great importance. Slotted angle or specially designed work supports can create storage capacity in spaces otherwise difficult to use, and can sometimes be provided as project work by the college itself. The provision of suitable mechanical handling devices to facilitate the safe transfer of items in and out of storage is a matter which appears to have received surprisingly little attention in colleges. Well thought-out storage methods and control are necessary to ensure that equipment is properly cared for and available when required.

Equipment

Joint use within and between colleges

33. We have already indicated that we doubt whether the provision of separate laboratories for different specialisms is always justified; similar considerations apply to equipment. Often permanent installations are not necessary, and the question of sharing under-used equipment between colleges as well as between departments should always be examined. The movement of heavy equipment is a normal industrial task. Joint use of specialised machinery by several colleges may make it possible to buy better and more expensive equipment; all the colleges can stage a viable course and the machines can circulate within the group. This, of course, involves programming the year's work in close co-operation between the colleges.

34. In some cases classes and teachers travel to other colleges to use equipment. This achieves improved utilisation of equipment but not of student/staff time, and its possibilities are limited unless colleges are close together. On the other hand certain kinds of equipment can be transferred from place to place. A well-known industrial firm has installed a quality control laboratory/classroom in a large caravan which is moved between its factories. A number of machine tool firms have excellent travelling workshops for demonstration purposes.

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Not only can expense and storage space be saved by this method but it has the great advantage of increasing the opportunities for colleges to have access to expensive equipment in fields such as radiography, food chemistry and preparation, control engineering, precision measurement and advanced office equipment.

Preventative maintenance and planned replacement

35. Even a comparatively small technical college may have a wide range of tools, machinery and equipment worth as much as £200,000. Equipment may be used for up to 12 hours daily by inexperienced operators, often in unusually severe or experimental ways. Proper planned preventative maintenance is essential in order to avoid breakdowns, to reduce deterioration and to ensure safety. There are various ways by which this can be achieved. Several well-tried recording systems are available which allow maintenance operations to be charted and timetabled throughout the year, so ensuring regular servicing. Where conditions permit, a maintenance workshop can be set up allowing spares, supplies and tools to be properly stored and controlled. If the equipment is transportable, servicing work can be done off the site: the rooms can then continue to be used for teaching.

36. A good maintenance staff needs the equipment and skills required for lifting, moving and installing equipment, for the inspection and modification of services, and for work such as moving and erecting partitions, demountable walls and shelving. It should also be capable of undertaking changes in layout, alterations to services and similar work which is necessitated by changing needs.

37. With a good maintenance workshop, machine tools and other sizeable units can be removed from service for reconditioning. This is preferable to having machines standing idle and semi-stripped in the teaching room, but it is not always the best course. Firstly, it may be less economical than having the work done by commercial firms with specialised equipment and labour. Secondly, a reconditioned machine, though usable, may not be sufficiently modern in design and performance, and the right course may be to replace the machine. As a general rule it is important that colleges should use up to date equipment in their teaching. In view of the high usage which much of the equipment will have, especially in workshops, replacement after say 8 or 10 years may in any case be economic. We were informed that some local education authorities have no formal provision for depreciation and replacement. We suggest that local education authorities should review their existing arrangements to ensure that there is appropriate provision for planned replacement.

Maintenance and cleaning services

38. Continuous use of rooms during the day creates problems of cleaning. Some colleges have solved this difficulty by operating a night shift cleaning service. The maintenance of equipment which is in constant use involves similar problems. We have been told that in some cases regular routine maintenance is carried out while the classes are in session: this gives the students opportunities for learning about maintenance of machinery as well as its operation. On the other hand we have not heard of the use of maintenance labour on night shift

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on the lines common in industry. We recommend that, where the full use of accommodation and equipment is restricted because of the need for cleaning and maintenance, the possibility of organising these services on a night shift basis should be considered.

Self help

39. It has been put to us that there are many situations where teachers and students in technical colleges could with advantage make a direct contribution to the work of maintenance and adaptation which is necessary in order to ensure the full use of accommodation and equipment and to meet changing needs. A high proportion of technical teachers enter colleges after experience in industry, often in responsible posts where they have been engaged on similar work. We would not of course suggest that teachers and students should be normally used in this way. To make it a general practice would be a gross mis-use of the services of teachers and students. At the same time many teachers are frustrated because they are prevented from undertaking even simple jobs which would improve their facilities, and it does not add to the respect of students for them that they appear to be incapable of doing in practice what they presume to be teaching. It gives credence to the all too common opinion that what is taught is one thing and what is done in the practical world outside the college is another. Subject to safeguards against abuse, we believe that it would often be both economical and educationally advantageous if within defined limits college staffs were given greater freedom to carry out alterations.

40. Much the same is true of the students. It is being increasingly recognised that to get the best results, work done by students needs to be realistic, meaningful, and significant to them. The extent of the help which students can give will necessarily be small, but it may be worthwhile, and it will be important to them. It may also add to their respect for premises and equipment.

41. This is not a new idea. In many colleges the work done by teachers and students has made a significant contribution to resources. In some cases machines reconditioned as student projects have been used for demonstration purposes; in others equipment has been manufactured in workshop classes for use in laboratory and classroom. Such activities have an educational value because they are purposeful. They demand careful planning and progressing which may also be highly educative. We recommend that local education authorities should consider what further encouragement can be given to self-help by colleges on these lines.

Co-operation with industry

42. Colleges already receive invaluable help from industry in various ways. The following paragraphs suggest one or two additional means by which this co-operation could be further developed in the context of our enquiry.

Requirement for courses

43. We have already referred (paragraph 20) to the difficulty which colleges experience in achieving an even loading of their accommodation with courses differing in length. This is aggravated where employers press that their day

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release students shall attend on specific days of the week. We are sure that if the position is explained to them employers will co-operate as far as they can in releasing students at the times which will enable the college to provide a better educational service by using its resources most effectively.

Use of industrial facilities

44. We would like to see greater use by colleges of equipment in industry, as distinct from merely visits of inspection. Where equipment is used continuously there is obviously little chance of outside use. Some equipment is not in continuous use, however, and may be available for significant periods. When machines are dismantled for examination or repair they present a unique opportunity for study. It seems to us that both employers and students would benefit if more use could be made of industrial facilities, and we hope that in co-operation with industry increasing numbers of colleges will explore the possibilities of using industrial facilities as part of their teaching programmes.

SUMMING UP

45. Before summarising our main findings, we wish to stress again that this report is based upon the steps already taken in colleges to make the best possible use of premises and equipment to meet growing and changing requirements. It owes a great deal to discussion with those who have tackled these problems in the field. Nobody would suggest that there are simple answers to most of these problems, and the situation at different colleges will never be exactly the same. For the most part we have confined ourselves to examples and suggestions based on actual practice which we think will be of interest to others engaged in technical college teaching and administration.

46. We are also fully aware of the limitations upon what can be done by way of modifying and adapting existing premises or by improvements in timetabling and other methods of getting the best out of the available accommodation. But, as we have said, it is not long before even new buildings inevitably become out of date, and the next few years are likely to see further rapid changes in needs and practices. This report will have served one of its chief purposes if it stimulates further thought and discussion on the best methods of using buildings and equipment and adapting them to new educational pressures and requirements. We find it encouraging, not only that these questions have already received so much imaginative consideration in the colleges themselves, but that it has so often been found possible to tackle them not only without reducing educational standards but with educational gain. Not the least of the advantages are the possibilities through improved organisation of using better and more expensive equipment for the same or lower expenditure and of releasing resources for other important pusposes such as the improvement of the communal facilities which are so essential to the life of the college as an academic community.

47. SUMMARY OF MAIN FINDINGS

(1) Regular surveys of accommodation and equipment usage and careful timetabling are essential to the most effective use of buildings and equipment (paragraphs 9–11).

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(2) Greater flexibility in course and timetabling arrangements, and hence in the use of resources, would result if external examining and other bodies were able to give colleges more freedom, within the overall course-patterns laid down, to plan the detailed time allocations for individual subjects, and if the incidence of external examinations could be reduced (paragraphs 21 and 22).

(3) There is considerable potential for the use of classrooms for a greater variety of purposes, especially if the rooms are furnished with an eye to variety of use, and their use planned between several departments (paragraphs 23–26).

(4) There is similar scope for more effective use of laboratories, particularly through the combination of facilities for related subjects, the provision of portable and adaptable furnishings, and better layout and storage (paragraphs 28 and 29).

(5) More effective use of workshops can be achieved through arranging or rearranging their location to permit flexibility of use for related courses and through greater attention to the portability and storage of equipment (paragraphs 30–32).

(6) Fuller use of equipment could be made if two or more colleges could share expensive or specialised items, and better preventative maintenance and facilities for planned replacement provided (paragraphs 33–37).

(7) Teachers and students may be able to help towards the more effective use of accommodation and equipment by sharing in the practical work of improving facilities in various ways, and this kind of self-help is worthy of encouragement (paragraph 41).

(8) Industry can help colleges make better use of resources by timing the release of students with an eye to the load on college accommodation and enabling colleges to have more use of industrial facilities, particularly equipment (paragraphs 43–44).

November, 1967.

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Appendix I

LETTERS RECEIVED BY THE COMMITTEE

1. Timetabling

1.1. 'Whilst each department has specialist rooms and classrooms allocated to it in general terms, no department has absolute control of any teaching space. The Heads are expected to work as a team and to solve accommodation problems by providing rooms for one another as circumstances demand.'

1.2. 'The classrooms consist of specialist rooms and general purposes rooms. The specialist rooms are allocated to particular departments, and timetabling ensures that each department uses its specialist rooms continually. The general purposes rooms, however, are pooled between the different departments: this ensures maximum use, and provides flexibility for timetabling.'

1.3. 'Programmes are timetabled centrally and departmental timetables are integrated so that the fullest use is made of all accommodation throughout the College. Although each department has its own suite of rooms, the use of these is not restricted, appropriate rooms being made available to other departments as required.'

1.4. 'We have achieved quite a high degree of general usage of accommodation subsequent to the "first call" of the department to which accommodation is allocated. This has been done by putting the Vice Principal in over-all charge of the allocation of rooms and then instructing the Heads of Departments to feed to him room schedules at the beginning of the session. Vacant spaces in one department's allocation have been used to accommodate overflow from another department.'

1.5. 'We have arranged most of our day-time classes in periods of 40/45 minutes in all departments. This allows for flexibility in staffing and the use of rooms. In particular, the teachers of General Studies who take classes in more than one department can have timetables which fit these periods without overlapping. The allocation of rooms is made much easier.'

1.6. 'Timetabling in teaching units of 40 minutes to allow economical use of teaching time, particularly where one department provides teaching services to other departments.'

1.7. 'By arranging "tea-time" classes (4.30–6.30) practical rooms such as laboratories, engineering workshops and drawing offices can be used from 8.45 a.m. to 9.30 p.m.'

1.8. 'Because of restriction in a particular workshop, we have for the past year operated split-shift working for some of our heating and ventilating students. With only one shop, and using normal hours for block release, i.e. 9.00 a.m. to 5.00 p.m., we would get an absolute gross daily usage of eight hours. This was insufficient for the needs of the courses and consequently we now operate from 8.30 a.m. to 6.30 p.m. giving ten hours usage by bringing at least one group of the four into the college from 8.30 a.m. to 4.30 p.m. and at least one from 10.30 a.m. to 6.30 p.m. each day of the week.

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Furthermore by building up timetable patterns for the four groups, we endeavour to avoid all "break" periods, i.e. mid-morning, lunch and mid-afternoon. This can be accomplished by varying the times of classroom subjects to allow continuous end-on use of the workshops, i.e. one group has break at end of workshop period, whilst another group has break arranged immediately before this time. This arrangement has the added advantage that it provides a staggered flow through the refectory, but on the other hand it makes staff time-tabling more difficult.'

1.9. 'Where students are in attendance during the day time, it has been possible in some cases to arrange for them to attend an evening class from say 5.00 p.m. to 7.00 p.m., thus making the rooms available from 7.00 p.m. onwards for normal evening classes.'

'I suggest that consideration be given at national level to coupling with any requirement of industry to grant day release, the option to the student to attend in the morning and afternoon, the morning and evening or the afternoon and evening of the day release.

The position at the moment with many firms is that if a student were asked to attend the College in the morning and evening, he would be expected to work at the firm in the afternoon.'

1.10. 'No block release course is offered unless there are sufficient students to form viable groups that can Box and Cox throughout the session.'

1.11. 'We are one of the colleges which has adopted the "end-on" system in respect of sandwich courses of the six months/six months pattern. This has enabled us both in Applied Physics and in Electrical Engineering to double our annual intake of sandwich students by making continuous use of the teaching accommodation throughout eleven months of the year. In our experience this arrangement has presented no insuperable difficulties and has, in fact, worked very satisfactorily.'

1.12. 'Our system of block release in engineering courses has been developed very largely on a module of nine weeks. Craft and Technician blocks last nine weeks per year, Ordinary National Certificate and Higher National Certificate blocks last eighteen weeks per year. Sandwich courses at diploma level are arranged on eighteen weeks first year, eighteen weeks second year and thirty-six weeks third year. This gives a variety of end-on arrangements so that it is possible for the accommodation to be used to the full for a college year of about thirty-six weeks. The arrangement of sandwich courses is, as far as I know, unique but there is no evidence to suggest that it is not at least as satisfactory as the usual method of twentyfour weeks per year.'

1.13. 'The advent of "block release" has undoubtedly made timetabling more difficult. It is possible that if the College were all block release, with many alternative courses, it would become easier again. At the present stage of development, where the block release is intermittent, rooms have to be made available on a six-weeks' basis, and room timetables altered every six weeks. On the other hand, block release courses carry on in the so-called "vacation period", which is a corresponding saving on accommodation which previously lay empty.'

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1.14. 'As far as possible every department works to the same divisions of time during the day so that accommodation (and staff) are not left idle for short periods. This is, however, becoming increasingly difficult because the minimum number of hours which have to be worked with each subject in each National Certificate course is continually being increased by the Joint Committees, thereby reducing flexibility in timetabling. Timetabling could become much more flexible if Joint Committees prescribed the total hours to be covered by a course and left it to colleges to divide this amongst the various subjects to give a reasonable balance.'

1.15. 'We have no hesitation in splitting up lengthy periods of instruction into smaller units. Thus a group which is required by the Scheme or Regulation to have two hours of Mathematics may well have this as two separate periods of one hour each. Not only is it good educationally, but it adds a degree of flexibility to timetabling—it is easier to find rooms available for one hour than for two consecutive hours.'

1.16. 'Where laboratories are only required for approximately one-third of the attendance of the class, we have arranged that two classrooms and one laboratory be used at the same time—thus obtaining full use of both classrooms and laboratory.'

1.17. 'Careful selection has also to be made for classes occupying annexes and outbuildings to ensure that the column of human traffic required to travel between sets of premises, especially when many classes are on a one hour basis, is kept to a minimum to avoid waste of time and dislocation in the overall set-up. In these cases, it is expedient to have the lecturer on the move and the students stationary.'

1.18. 'Often it is found that the proportion of practical work in one course is similar to that in another course or another two courses, when a "ring" system of two or three courses is found to operate well. This involves for three courses, two lecture/demonstration rooms, and one laboratory. Each course uses the lab on a rota of once each three weeks. If the courses are carefully chosen, the equipment required for each course can be very similar, so reducing the transfer of equipment between the laboratory and store to a minimum.'

2. Classrooms

2.1. 'More rooms should be of the lecture/demonstration type so that demonstrations of standard experiments could be carried out which, with the increasingly concentrated subject matter content of courses, could in turn lead to more imaginative use of laboratory time, e.g. for project work, etc. Likewise, the equipping of all lecture rooms with blackouts and power points would make possible the wider use of visual aids.'

'The Motor Vehicle room is at present arranged to double as a lecture room for related studies and demonstrations. It is an advantage that other groups do not use the room because there is a great deal of specialised equipment, which cannot always be locked away.'

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2.2. 'In a number of rooms we are using a type of chair with upholstered seats and backs and with a writing table surface veneered formica attachment. This takes up a great deal less room than the more traditional types of tables and chairs so that either the standard room can accommodate more students or smaller rooms can be used for large groups.'

2.3. 'Building craft courses and some of the Engineering courses, having integrated study schemes, require infrequent and irregular use of specialist facilities, e.g. for drawing and practical demonstrations. The provision of a demonstration bench with services in a drawing office, the provision of racks for drawing boards and tee squares attached to science laboratory benches, and the use of dual purpose furniture (desk-cum-drawing table) has reduced the need for classes to move from one room to another, and avoided the monopolisation of specialist accommodation by classes requiring such accommodation for only a small proportion of their time.'

2.4. 'A lot of our classes are combined for formal lectures, with groups of sixty or more students, and the few large lecture rooms that we have are fully used for this purpose. These lectures are of course supplemented by tutorial classes in groups of twenty and the net gain in accommodation is not great.'

2.5. 'The use of "team teaching" methods can allow a room to be used for a number of subjects and to contain suitable equipment for these subjects. Much can be done by goodwill on the part of those concerned.'

2.6. 'Most classrooms are quite large and we are now in the process of placing benches to the rear and the sides of the rooms to allow simple engineering science experiments to be performed in the classroom without recourse to a laboratory. Much of this equipment is to be manufactured in the College workshops. This is of growing importance with the introduction of more "common" mechanical and electrical syllabuses, e.g. G1 and G2.'

2.7. 'Consideration should also be given to sizes of classrooms in technical colleges. Classrooms to take more than 24 students are rarely required, and classrooms to take between 12 and 18 are often adequate, particularly for senior work.'

2.8. 'Rooms can be grouped, wired on common circuits for earphones or closed circuit television. This can avoid unnecessary movement of classes and enable large groups to be taught at one time.'

2.9. 'Increased efficiency in the use of typewriters and in shorthand teaching has been effected by the invention of a system presenting multiple programmes from tape-recorded material. Two classrooms are equipped with programme-presentation decks, 20/24 listening points, and monitor devices to enable the teacher to listen to any programme and to give individual attention as required. A very considerable saving of teacher-time otherwise spent dictating and giving instructions in the classroom has been effected. The College has also developed a recording and copying studio for the making of programme material. Sound broadcast equipment for the more efficient presentation of sound film, speech, etc., in the College has been developed by the college staff.'

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2.10. 'In the Typewriting room, "L" shaped desks have been designed and supplied with the two legs of the "L" at different levels so that the students can face one way when doing typewriting practice and another way when doing shorthand or other class subjects. This is a considerable improvement on the old type of desk onto which the typewriter could fold.'

3. **Laboratories**

3.1. 'Building Department drawing offices can also be used as laboratories. Each drawing office has a demonstration bench and a long wall fixed bench with all services to permit the teaching of some craft science as and when it arises in the theory lesson.'

3.2. 'One laboratory has been converted into a dual purpose laboratory and lecture room. All services are around the walls and the centre benches have been removed. These have been replaced by formica topped tables and chairs. Normal class work can be carried out at these tables also a number of experiments. When the services are required the tables are moved to the sides. This laboratory is situated at the top of a building. It has television and black-out curtains for using projector and other visual aids. Once again movement of students is avoided and time saved. I would recommend this type of laboratory for lower level work in any college, especially in new colleges.'

3.3. 'For the laboratories very little static equipment is used. The motor-generator sets and ancillary equipment are mounted on trolleys, constructed from slotted angle iron of proprietary make, and are moved when required to fixed testing benches to which a variety of supplies can be switched. The experimental electrical equipment is fitted with all the necessary terminals, switches, and control gear, but all the connecting up is undertaken by the students.

The experimental machine sets and associated equipment, when not in use, are stored in a "machine park" which separates two laboratories, and can be curtained off by two steel roller-shuttered doors. Thus the same equipment can be wheeled into either the Elementary or Advanced Machines Laboratory as the standard of work requires. Storage in the "machine park" allows the cleaning down, painting and servicing of the machines to continue without interrupting the continual usage of the laboratories.

In addition to the testing benches, the laboratories are provided with island type benches which can be bridged by removable panels. These allow the area of the working surfaces to be extended when large experiments are set up. In the Advanced Machines Laboratory trolley type tables serve the same purpose and can be wheeled between adjacent tables to provide a large continuous working surface.'

3.4. 'Many workshops and laboratories are used for dual purposes, i.e. Fitting/Plumbing; Motor Vehicle/Agricultural Engineering; Physics/Biology; Demonstration Cookery/Restaurant, etc. I would suggest that greater flexibility could be achieved if laboratories, etc., were designed to have a common store between two rooms with access from the corridor for laboratory stewards, etc.'

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3.5. 'Multi-purpose laboratories are frequently used. Thus one laboratory is equipped to deal with horticulture, science, biology, and some elementary metallurgy.'

3.6. 'At one establishment Physics and Biology laboratories have been equipped with plain bench tops which are adequate for practical work while enabling the rooms to be used for lectures in these and other subjects. (Bench services are placed unobtrusively at the back of the benches and sinks are located at the extreme ends of benches or on side walls.)'

3.7. 'It has been found that in a Technology Laboratory the placing of wall benches on two sides of the room and tables and chairs in the centre permits the use of such an area for fitting work as well as for Technology with Craft and Technician courses. A little used Ventilation Laboratory can be used as a film projection room at times when not occupied for its prime function.'

3.8. 'Originally three laboratories were set up to deal with the then (1959) requirements of three separate departments. The growth of General Course work indicated that all possessed common factors of requirements. The three laboratories were re-cast to form a laboratory suite to deal with, separately, mechanics, electrical science, heat and optics (physics). The standard and quality of the equipment that could then be provided was much higher than that that had been provided for general purpose laboratories.

The scheme of teaching work is now much more flexible as each lecturer has a choice of three individual subject section laboratories available to correlate practical work and lecture work.

The essentials are:—

(*a*) One person in ultimate charge of each laboratory, supported by a small team from other user departments. The member of staff with the ultimate responsibility must be allowed to organise his laboratory on a "whole college service basis".

(*b*) The rooms must be capable of time-grouping of laboratory activities or demonstration work as required.

(*c*) Adequate close support from technician staff must be provided.

There was some initial opposition to the scheme from departmental staff, but after two years of operation all admit that the scheme provides a better service, and they are very satisfied with the results.'

3.9. 'In laboratories, water, gas and electric power points are provided on side benches only so that the laboratory can be furnished with free-standing tables and can therefore be used as a classroom, drawing office or craft room.'

3.10. 'The name on the door of a laboratory/shop is not important; what takes place—or could take place—inside *is* important. Thus in one college there were nominally one Physics and one Elementary Science and two Engineering Science Laboratories. Had they been reserved strictly to their designated purposes, some of these spaces would have been over-loaded

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and others under used. By duplicating equipment at relatively low cost, each laboratory was able to fulfil a purpose similar to the others, with an all-round gain in flexibility of time-tabling and effective utilisation and servicing of all the spaces. It is freely admitted that as the academic level of work rises the laboratories tend to become more specific in purpose, but at quite high academic levels the principle can still operate, e.g. if appropriate facilities are available, a Strength of Materials Laboratory can serve mechanical/production engineers and builders.

I suggest that we have to get away from the concept that only students of a given class should occupy a laboratory/shop at a given time. Except in very elementary work, the amount of class instruction carried out in such spaces is negligible. All students are not engaged upon the same exercise, and even in cases where the class as a whole does start upon a given exercise, students proceed at different rates dependent upon their familiarity with the task, their grasp of the fundamental principles, their individual dexterity. Thus the teacher's work becomes tutorial in nature. Hence students from different groups and indeed different (but associated) disciplines can work effectively side by side within the same specialist teaching space.

This is especially important at post O.N.C. level where colleges are urged to offer a wide range of specialisms to suit students' needs and "splinter groups", leading to uneconomic use of expensive equipment, facilities, and senior teaching staff, is an ever-present problem. Such undesirable consequences can to some extent be avoided provided that:—

(*a*) the teaching spaces are planned on generous lines with a view to flexible usage.

(*b*) separate bodies responsible for approving syllabuses do not unreasonably insist upon minor amendments to syllabuses which colleges have designed with a view to bringing together students from different disciplines.

(*c*) appropriate laboratory sheets and instructions are always available for students' use. This presupposes that adequate clerical assistance is provided.

(*d*) equipment is maintained in good condition, rigs have been set up as required and dismantled when the exercise is finished, staff have carried out the essential development work to ensure that the equipment as set up is capable of illustrating effectively the principle intended, and minor service work and running repairs are carried out immediately. All this presupposes that adequate laboratory staff are available so that senior teaching staff are free to devote their time and energies to teaching rather than to service work which is within the competence of skilled technicians.'

3.11. 'Wherever possible, rooms are dual purpose. In some instances, laboratories have services on narrow wall-shelves at table height so that tables can be moved up to the shelves for practical work or arranged centrally for class work.'

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3.12. 'There is much to be said for a science-type laboratory being so designed that it can be used teaching the theoretical work on the subject as well as the practical work instead of the normal laboratory for practical work. Educationally it has much to recommend it since there can be a closer integration of theory and practice. Whether there are advantages in the physical utilisation of room space obviously depends on the demands of the laboratory for practical work but, unless the requirements for practical work are such that the laboratory can be fully utilised for practical work only, classroom space will be saved by doing the teaching of theory in the laboratory.'

4. **Workshops**

4.1. 'Our machine shops are arranged around a central common store so that store-keeping labour is used to fullest advantage. Similarly, a Physics store is sited between two laboratories and the Electrical Engineering store between two laboratories.'

'A Chemical Plant Laboratory has been designed to be self-contained for maximum usage as follows:—

(i) Part of the laboratory is set aside for teaching.

(ii) Elementary Chemistry may be carried out at side benches.

(iii) Laboratory practice on large scale apparatus is carried out in the rest of the laboratory.'

'An Electrical Installation laboratory was designed for Electrical Installation practice to be carried out in booths, etc., at the rear of the room whilst teaching could be carried out at the front of the room. The benches were designed to be suitable for student classroom use or alternatively for practical work on wiring on boards.'

4.2. 'In the case of engineering laboratories and workshops, it is preferable to have large units which can simultaneously accommodate more than one class, rather than small individual workshops which have neither the flexibility nor the range of equipment. In the case of laboratories the artificial division of apparatus for different topics again leads to difficulties if changes in course and syllabus content require changes of apparatus and other equipment in the future. Flexibility and common services should be aimed for at all times.'

4.3. 'The erection of transparent screens in a large workshop allows different sections to be accommodated without undue interference with one another. Staff can see several sections at one time, and natural lighting is not obscured.'

4.4. 'The College has installed 440v 3-phase bus bar trunking systems in the senior workshops, the workshop processes laboratory and the machine tools laboratory. This has made possible easy re-arrangement of the layout when required and means that interchange of equipment is now quite simple and can be carried out by our own labour.'

4.5. 'Machine Shop arranged with overhead electric bus bars for powering machine tools. Machines are positioned in approximately straight lines

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beneath the bus bars, which are easily tapped for power provision to each machine by means of vertical conduits.

Advantage: Avoids channelling the shop floor, and additional machines are readily connected.'

4.6. 'Machine Shops: All machine tools are carried on patent mounts—no machinery bolted to floors. All power supplied carried on overhead bus bars. No interference with floor surfaces. Layout can be changed without difficulty and even reciprocating machine tools, e.g. shapers, have proved entirely satisfactory when installed in this way.'

4.7. 'A building with a barrel vault reinforced concrete roof springing from beams at approximately 14 feet above floor level and intended principally for workshops and laboratories for the Departments of Building and Engineering, provides more than sufficient head room for certain requirements. Some of this top space has been utilised in the following ways:—

(*a*) In an Engineering Workshop, floor space has been made available by raising the teacher's office above floor level.

(*b*) In a Plumbing Workshop, additional space has been provided by the building of a gallery over part of the room and fitting this with cubicles which are used for demonstrations of domestic plumbing services.

(*c*) A room originally intended as a store has been fitted with a mezzanine floor. The lower room is used as a Metrology Laboratory, the upper room as a Photoelasticity Laboratory.

(*d*) A number of stores have been provided in the upper space.'

4.8. 'In Building Workshops, storage cupboards raised above head level and fixed to walls to save floor space. Vices supported on single legs and hinged to back against wall. Setting out tables to be loose tops on trestles to allow removal and use of space for building up of large exercises.'

4.9. 'High level storage and careful arrangement of floor space has made it possible to use a workshop for car maintenance, welding and woodwork.'

4.10. 'For older type buildings where ceiling height is higher than usual, the following constructions can be useful:—

(*a*) An intermediate gantry type of floor to give storage space; such a floor can increase the working space particularly in a brick workshop.

(*b*) The erection of scaffolding which helps students to simulate actual site working conditions.

Brick workshops should contain stands on wheels specially designed to allow brickwork models to be transported and so provide space at other times during a week.'

4.11. 'The construction of the greater part of the Technical College is based on flexibility. The services are all central ducts, and can be adapted to various purposes with a minimum extent of alterations. The divisions between the rooms are all of a temporary construction so that modifications are comparatively easy.

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The workshops are fitted out to provide Machine Shop work and Bench-Fitting work all in the same workshop; there are no specialist workshops, one for machine work and one for bench-fitting work.

The College has a lecture-room/laboratory for General Science subjects. One room is specially arranged for Mathematics.'

4.12. 'An example of the development of the principle of arranging rooms for multi-purpose use is the conception of the proposed new building crafts workshop block. In simple terms, the building will be a shell providing two open floors of maximum area. The lower floor will provide for brickwork and plumbing, the upper floor for woodworking machinery and carpentry and joinery. The boundaries of any section will be marked either by the layout of benches, or by de-mountable screens. Class areas can then be changed at will.'

4.13. 'With the introduction of new courses, changes in syllabus of existing courses, etc., it is not always possible to use accommodation in the way originally intended and adaptation and improvision must of necessity be made. We [the Authority] are, however, rather cautious about the use of a room for more than one purpose because this can mean that it is not completely suitable for any purpose. Flexibility as far as the Authority's schemes for new buildings are concerned is more evident in the provision of services in such a way that a change of use of room is not restricted and the juxtaposition of rooms so that the work of departments can expand (or contract) relatively easily. Examples are the open workshops and dual purpose laboratories planned in new colleges for further education (local colleges). Multi-purpose use of rooms (i.e. lectures, demonstrations and experiments within limits) has been achieved by unit construction services which can be moved or added to. In this respect services should be on ring main system.'

4.14. 'In workshops where both simple and advanced equipment are in use, machines are arranged so that the classes can work without interference. One workshop is to have dual-purpose benches for engineering and carpentry with "turn-over" tops.'

4.15. 'The electrical installation workshop is arranged to provide full facilities for practical work, and in addition to provide classroom accommodation. The arrangement is to provide a block of cubicles for practical work in the centre of the room with benches for practical work arranged along the walls. The top of the cubicles is provided with a flooring and staircase. This upper level is provided with benches, stools and a blackboard so that formal classroom teaching can be conducted. This arrangement is only possible because the room is lofty enough to allow a two-level construction.'

4.16. 'The Domestic Arts Department has, for some time, used rooms for either hairdressing or needlecraft subjects by a suitable arrangement of furniture and practical equipment. Fixed equipment for hairdressing, such as washbowls and hair-driers, is arranged along two of the walls of the room, and storage cupboards for portable equipment for both

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subjects is arranged along the third wall. The sewing machines required for the needlecraft subjects are arranged along the window wall of the room. Tables and chairs suitable for needlecraft are provided, and when required for hairdressing, fitments suitable for boardwork added to the tables or alternatively portable mirror.'

4.17. 'Centrally located service rooms with hatches opening to two or more workshops or laboratories have been provided.'

5. **Equipment**

5.1. 'Equipment and apparatus which is used for only a limited period during the year is shared between two colleges.'

5.2. 'Careful consideration is given to the planning and use of facilities which are common to more than one department and appropriate accommodation is shared as circumstances permit, e.g. a Pharmacy Biochemistry laboratory is also used as an overflow laboratory for Biology. Servicing of one department by another is, of course, common practice and there are many examples of the interchange of apparatus between departments.'

5.3. 'Strong encouragement and indeed pressure needed to expand the service aspect of College work which economises in preventing duplication and allows higher standards of equipping if centrally organised. Printing, photo-copying, duplicating in the more sophisticated levels gain from central location. Materials are used quickly and do not deteriorate and specialists can assess the cheapest method in relation to the job, maintenance is enhanced and so forth. Distilled water from one central plant. Extensive surveying equipment based in Mining used on loan in lower levels and with specialist staff in higher level courses by Civil Engineering department. Mathematics calculating machines used by other departments and courses. Electrical facilities available for Mining, etc.'

5.4. 'Departmental boundaries are being regarded more and more as only an administrative convenience. Full co-operation has always been maintained and the following examples are worthy of note: (1) A special short course of 120 hours in Instrumentation and Control for the C.E.G.B. was a joint effort, (2) the increasing use of electrical and electronic devices by the department of Mechanical and Production Engineering has brought advantages to staff and students in both the Electrical and Mechanical Departments, (3) Venturi flow apparatus and vibration equipment of the Mechanical Department has been made available to Instrument Maintenance courses in the Electrical Department.'

5.5. 'Much of the equipment is housed in self-contained units fitted with wheels so that they can be moved to one end of a room when not in use, thus permitting the floor space to be used for classroom purposes.'

5.6. 'Where workshop space is limited, certain machines can be placed on beds fitted with heavy castors. The machines can thus be stored away when not in use, and transported from one room to another if necessary.'

5.7. 'Equipment mounted on castors in electronics, control, mechanical workshops, electrical machine laboratories and office equipment rooms.

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Heavier equipment mounted on sledges to give flexibility of arrangement. Electrical supplies in the latter case coming down from roof as and when required.'

5.8. 'In a Hydraulics Laboratory there used to be large rigs permanently established with water supplies and draining systems through which the water flowed to waste. There are now available hydraulics tables on which a most valuable range of experiments may be carried out. They measure about 2′ 3″ × 3′ 0″, are mounted on castors so that they are perfectly mobile, and employ a continuously circulating system so that they do not require to be connected to a water supply. Thus they can be moved into, out of, or about the laboratory as required, thus economising upon laboratory space and they can be moved to another laboratory as need arises, thus adding to the general flexibility of organisation.'

5.9. 'If it is possible to get lightweight portable versions of equipment, this is often preferable since it can be used in any classroom or laboratory. Sometimes the heavier equipment or even permanent sets of equipment can be built into trolleys which can be moved wherever is most convenient at the time of use.'

5.10. 'By using tape recorders and equipment made by a member of staff, students in shorthand classes can take down dictation at different speeds, thus enabling small classes of various speeds to be combined.'

5.11. 'Dictating machines—A simple "home-made" attachment allows these machines, mounted on trolleys, to be moved into classrooms where recorded programmes can be used in shorthand lessons with different groups working at different speeds.

Considerable use is made of portable equipment which is moved from laboratories to classrooms by trolley trays.'

6. Self-help

6.1. 'Design and construction of 16-booth language laboratory at approximately 50 per cent of the cost of a commercial laboratory.
Similar do-it-yourself construction of audio-typing room with facilities for transferring master recording to each of twelve machines, each student controlling own machine.'

6.2. 'An erection consisting of lightweight aluminium scaffolding has been designed and built by the College to enable the Lecture Theatre to be turned into an acting area for Drama. The materials used take up very little space for storage.'

6.3. 'In the fitting shop tool-stores, for example, special steel cabinets were designed for the storage of special tools. These consist of shelves and drawers. The drawers are two deep—one behind the other, the back drawer containing the more expensive and less-used tools.'

6.4. 'Some classrooms have been equipped with special services, in gas, electricity, water, and black-out facilities, to give dual purpose use. Physics apparatus for individual experiments, many of which are common

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to different courses, is self-contained in shallow, open wooden boxes made in the College. These boxes are of uniform size for storage and are labelled on the front with the experiment number and a brief list of any additional apparatus required. This system saves preparation time and eases storage and distribution problems. Restricted space limits the range of experiments stored in this way to those currently in use. This simplifies the "filing-system" however and does not tie up apparatus unnecessarily.'

6.5. 'At present the Department of Building is extending its facilities by the construction of an erection workshop. The complete design and erection is being carried out as a teaching project by students under staff direction, in the department.'

6.6. 'Full-time students need storage space for their books and materials but it is wasteful to build furniture to take account of this. The same standards of furniture are used for both full-time and part-time students and we have arranged for wooden lockers to be built in the corridors forming part of the corridor walls. These can become quite a decorative feature.'

6.7. 'The employment of skilled maintenance technicians on a full-time basis enables the teaching force to be more fully employed. Items of furniture and equipment have been designed and made by colleges, including the covering of desks with industrial formica at a cost of less than 30s. 0d. for a 4 ft. desk. This has reduced wear on desk surfaces and has facilitated cleaning. Certain central cloakrooms have been converted into classrooms.'

6.8. 'The function of several laboratories and workshops has been changed during the life of the College and this has only been possible by the goodwill and ability of the laboratory technicians and college engineer. It is essential wherever possible, to obtain the services of technicians to suit the work of the College, e.g. in colleges carrying out considerable craft work. The above modification of rooms is unavoidable and hence it may be better to employ an electrician rather than an instrument mechanic and have the few instrument repairs carried out by an outside firm.'

6.9. 'Facilities to change the size and use of rooms at short notice are essential. The greatest speed and economy can be achieved by having sufficient maintenance staff in the College to carry out adaptations.'

7. Co-operation from Industry

7.1. 'Practical project work is undertaken by students in their normal place of employment. This has been arranged with the courses in Fabrication of Steelwork and Work Study.'

7.2. 'Students in the Department of Business and Management Studies spend periods of time with firms in connection with practical management problems.'

7.3. 'In agriculture and agricultural engineering, there is close liaison with farmers resulting in the use, by the College, of farmers' equipment, land, livestock, etc.'

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7.4. 'It was thought that it would be of great help to the mechanical technician student if he could actually see and handle various jigs and tools used in local industry. At one of our regular meetings with Training and Personnel Officers their help was called for. The response was excellent. In came jigs and tools of all sorts together with the component on a permanent loan basis.'

7.5. 'Use of College plant by industry. The ship towing tank is a good example of this kind of co-operation and students are allowed to participate in development work by industry.'

7.6. 'Integrated courses of various kinds are offered in conjunction with the Electricity Supply, Electricity Generation, British Railways, and other nationalised industries. The courses cover the theoretical content of the subject in the Technical College, the practical work being carried out in the industrial workshops. All work performed outside the College is examined regularly by College staff and the closest co-operation is readily achieved.'

7.7. 'An extra mural teaching service has been established in respect of particular courses, and classes are held in a Police Training School and in a local factory.'

7.8. 'The College teaching facilities have been extended by using accommodation available in industry, i.e. the Training Department of the Gas Board.'

7.9. 'Quite a number of courses have been organised and run in works offices. Although this is somewhat more difficult as far as office administration is concerned, it does mean that foremen and employees attending this course, are only away from their work for the shortest possible time.'

7.10. 'By carefully planned purchase of second-hand equipment from specialist industry and the training of technicians to adapt such equipment a good many pieces of otherwise expensive assemblies in applied physics, instrumentation and electronics have been created which could not have been purchased in the form of brand new apparatus.

The present City and Guilds 310 Industrial Measurement and Control Technicians' Course is an outstanding example of co-operation between college and industry in that the specially equipped laboratories at the College and workshops of the Atomic Energy Authority are being used to provide an integrated practical course of optimum value. It might also be stated that the College is conducting linked courses for secondary schools whereby pupils ranging from grammar school sixth form to extended course secondary school pupils can profit from actual usage of laboratory and craft rooms, and the very special apparatus and equipment in the College which could not otherwise be provided by the schools themselves.'

7.11. 'The College has a special oven which a firm uses to exhibit at shows from time to time. Thus the College has use of it for long periods, and the firm is relieved of the necessity of providing storage space for it in the intervals between the shows.'

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Note on Procedure and Collection of Evidence

1. As explained in paragraph 8 of the report, the detailed conduct of the enquiry was carried out on behalf of the main Committee by a sub-Committee under the Chairmanship of Mr. J. Longden.

2. It was clear at the outset of the investigation that it would be necessary to establish how technical college buildings were used in practice. A fully comprehensive survey would have taken an unacceptably long time and would have been an additional burden on principals and staffs, and it was, therefore, decided to undertake a more limited survey confined to a number of selected colleges so that results could be obtained fairly quickly. To facilitate discussion a questionnaire was devised which recipients could answer and subsequently discuss at informal meetings with the Committee. The questions and analysis forms recipients were asked to complete are shown in Appendix III, and those who helped the investigation in this way are listed below.

3. **List of persons consulted informally by the Committee, showing appointment held at the time**

(i) DURHAM

Mr. G. Garland	Principal, Durham Technical College	

(ii) ESSEX

Mr. G. H. Marshall	Assistant Education Officer	
Dr. G. O. Stevens	Principal	North-East Essex Technical College, Colchester
Mr. A. C. Hutchinson	Principal Lecturer	

(iii) OLDHAM C.B.

Dr. E. M. Stoddart	Principal	Oldham Municipal Technical College
Mr. J. Kirkham	Vice-Principal	

(iv) PRESTON C.B.

Mr. B. L. Blake	Deputy Education Officer	
Dr. H. Wilkinson	Principal, Harris College	

(v) SOUTHAMPTON C.B.

Dr. J. J. B. Dempster	Chief Education Officer	
Mr. S. M. Boyce	Assistant Education Officer for Further Education	
Mr. A. Buckley	Principal	Southampton College of Technology
Mr. A. W. Nobbs	Vice-Principal and Head of Department of Building	

(vi) WARWICKSHIRE

Mr. P. C. Boulter	Assistant Education Officer	
Dr. G. S. Atkinson	Principal	Rugby College of Engineering Technology
Mr. A. Draper	Vice-Principal	
Mr. G. H. Tweddell	Principal	East Warwickshire College of Further Education
Mr. A. H. Old	Head of Engineering Department	

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4. Following these informal discussions—and largely as a result of them—the Committee wrote to all Chief Education Officers asking for information about the techniques used by their colleges to achieve a better use of accommodation and equipment. 124 replies were received and Appendix I has been compiled from the information supplied.

5. To enable the Committee to gain a closer understanding of the problems and see solutions being applied in practice, visits were arranged to:

Durham Technical College

Garrett's Green Technical College, Birmingham

Harris College, Preston

South-West Kent College of Technology, Dartford

By courtesy of The Marconi Company Limited, members were also able to visit the Company's multi-purpose training workshops at Chelmsford, Essex.

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Appendix III

Questionnaire (Form TCR/B/1)

A. Function and planning of practical rooms

1. Can you give examples of rooms which are in full and continuous use for their designed purpose? To what extent is this due to good layout and design, or to good organisation, or simply to demand?
2. Can you give examples of practical rooms which are serving more than one purpose, and say whether this assists or hinders full utilisation?
3. Can you quote or suggest changes in room layout, siting, or design which either have been or would be in the interests of improved utilisation?
4. In view of the new courses and change in course structures can you suggest changes in provision of accommodation and equipment, or in the method of use?

B. Timetable factors

1. Does the layout and planning of college premises allow students to transfer quickly between rooms, or facilitate breaks, and is this a significant factor in obtaining full utilisation?
2. To what extent are measures such as central control of room allocation, standard timetable grids, aggregation of classes for lecture periods, and block release courses likely to secure fuller utilisation of rooms?

C. Teaching accommodation

1. What size of classrooms are most useful and likely to achieve the best utilisation? How is classroom use related to the type of course and student?
2. Is there an increasing need for specialist classrooms, e.g. subject display or demonstration rooms? Under what conditions are such rooms justified and likely to be fully utilised?
3. What influence does the provision of visual aids have upon the full utilisation of classrooms and how far does this depend upon the method of dispensing visual aids?
4. To what extent is classroom space made available simultaneously for laboratory classes? How can this be avoided?
5. (*a*) Is (i) specialist accommodation and (ii) non-specialist accommodation shared between departments? If so, (i) what problems does this create? (ii) does it improve room usage?

   (*b*) How far ought colleges to aim at sharing rooms and equipment between departments?
6. (*a*) Do you share any facilities with another college? If so, what circumstances give rise to this and what are the advantages to be gained? If not, have you any suggestions to make on the sharing of facilities?

   (*b*) Could C.C.T.V. links help to share facilities, (i) between colleges; (ii) between departments; (iii) between classes?

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(*c*) Is the transfer of equipment between colleges feasible?

(*d*) Would a mobile laboratory (e.g. for radiography) be feasible?

(*e*) Should industry provide facilities for the use of equipment that would ease the burden of housing certain types of equipment? Is there any evidence of successful arrangements of this type?

D. Multi-purpose use of laboratories, workshops, equipment and engineering services

1. Are there any laboratories or workshops which, instead of being designated for particular levels of work and specialities, could, given extra storage for equipment, be used for several purposes in order to help timetabling and to make it easier to use rooms fully?
2. Would multi-purpose laboratories and workshops in the sense defined above help to keep accommodation fully occupied (i) in different departments in the same college and (ii) in two or more colleges?
3. Are rooms capable of being used for one purpose for, say half the year and, perhaps with some major re-arrangement, for another purpose for the remainder of the year?
4. Which subjects lend themselves best to multi-purpose use and at what level?
5. Are engineering services (e.g. electricity and gas) and equipment being fully used or are they insufficient to permit multi-purpose use of laboratories or workshops?
6. Does one laboratory or workshop have to have different engineering services from another in order to function properly?
7. How far can the movement of equipment help multi-purpose use?
8. How much would be gained by the design of multi-purpose furniture and equipment (e.g. drawing-cum-writing tables)?
9. What effect does size of room have on multi-purpose use?

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Appendix III
(Form TCR/B/2)

Name of College.....

If there are laboratories or workshops which in your opinion are not fully utilised, please enter below the name of each of these rooms, and place a tick in the appropriate box(es) to indicate the reason(s) for low usage:

Name of Laboratory or workshop	Room too small	Room too large	Limitations due to shape or situation	Limitations due to layout of equipment	Limitations due to furnishings or supplies	Shortages of equipment	Obsolescence of equipment	Problems of maintenance	Shortcomings of storage and/or preparation	Limitations due to non-teaching staff	Difficulties due to new courses	Increase or decrease in student numbers	Decline of particular subjects or courses	Shortage of teaching staff

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Appendix III
(Form TCR/B/3)

Committee on Technical College Resources
Buildings Sub-Committee

Name of College.....

Number of Hours in the College Working Week:— (i) Daytime.....
(ii) Evening.....

N.B. Please complete in respect of each laboratory or workshop.

1	2	3	4	5	6	7	8	
Department	Name of Laboratory or Workshop	Floor Area	Number of student places for which the room is designed	Is the room designed with special provision for class teaching	List of courses for which room is designed and equipped	Other courses for which room is used	Hours of use per week	
							(a) for the designed purpose	(b) for other teaching purposes